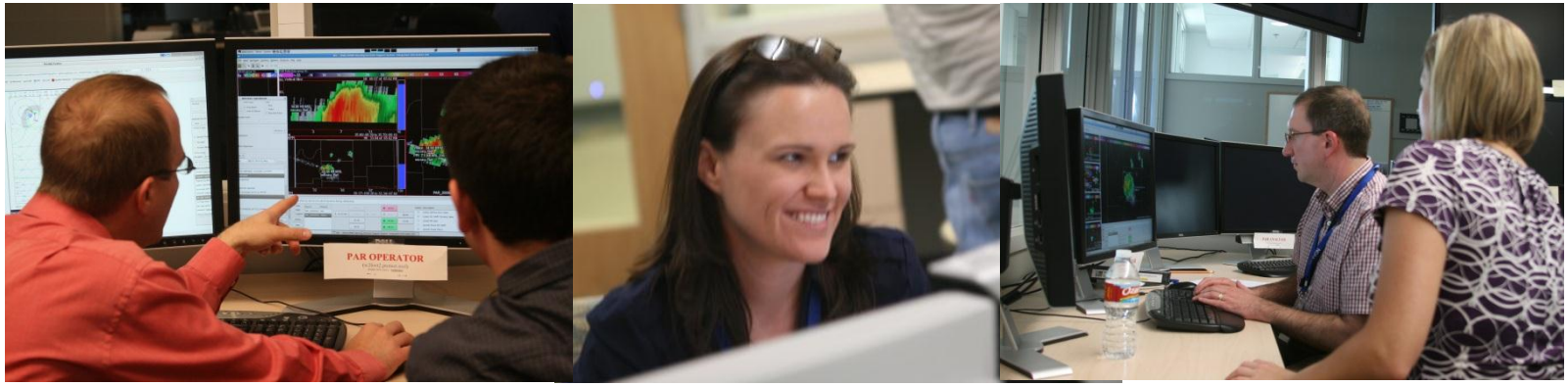
Verification of Simulated NWS Tornado Warnings During PARISE 2012



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D. LaDue
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OU CIMMS

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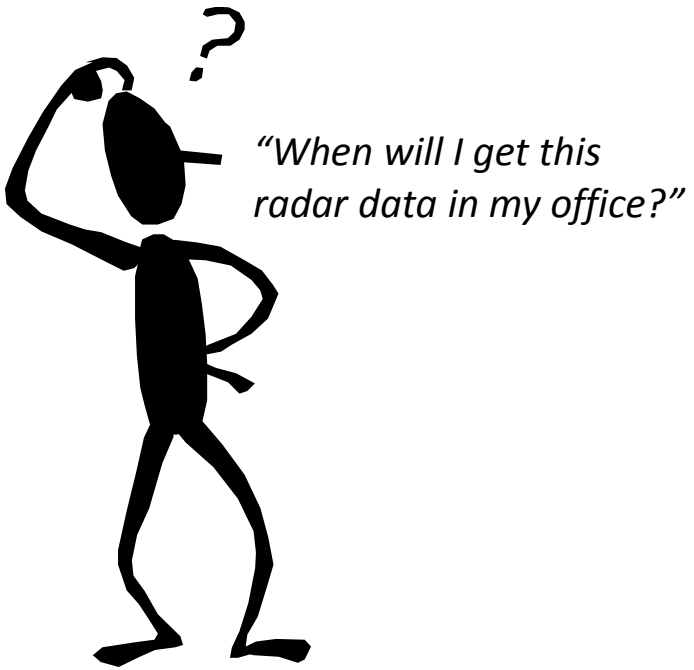
Inst. Human & Machine Cognition

B. MacAloney
NOAA Performance Branch

Motivation

2010 PARISE findings suggest faster, adaptive radar scanning can:

1) **Improve NWS forecaster ability to warn public of EF0/EF1 tornadoes**
2) **Increase tornado lead time: Average 12 min vs 0.76 min**
3) **Increase time available for public response**



"When will I get this radar data in my office?"

NWS Forecaster

More direct data collection methods?
Are these results repeatable?
What about null cases?

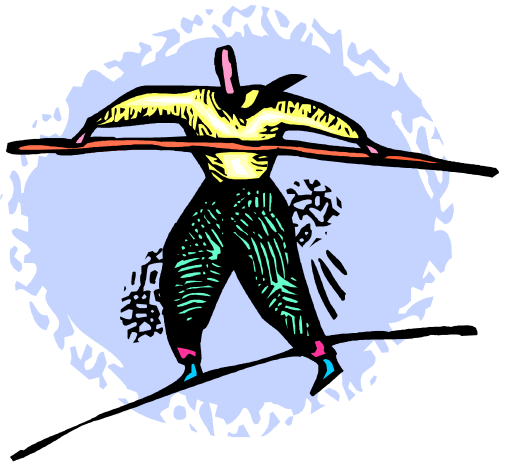
Scientist

Motivation

NWS Verification Statistics
1 January 2008 – 31 October 2012

	EF0/EF1 Tornadoes	EF2 + Tornadoes
# Events	6533	1188
% Unwarned w/in Class	27.5%	10.1%
% 0-min Lead Time w/in Class	30.6%	11.95%
Mean Lead Time	12.5 min	18 min

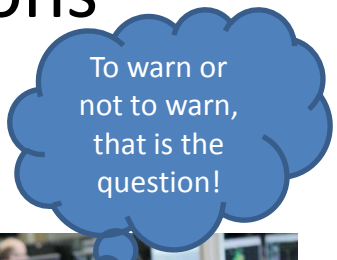
Across all events, 24.8% are unwarned, and 93.4% of those events are classified EF0/EF1.



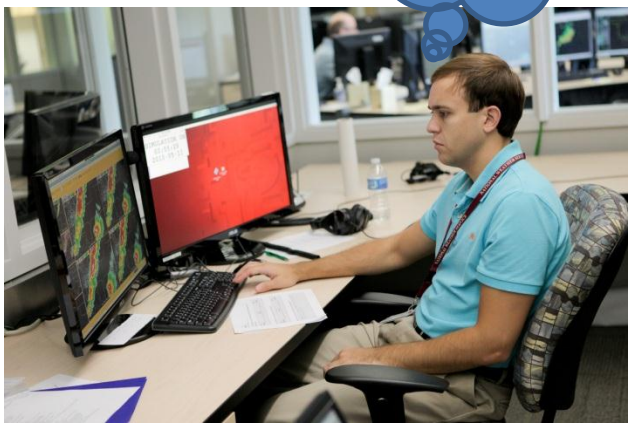
2012 PARISE

Objective

Test whether rapid, adaptively scanned radar data aids forecaster ability to make warning decisions during tough, potentially tornadic cases

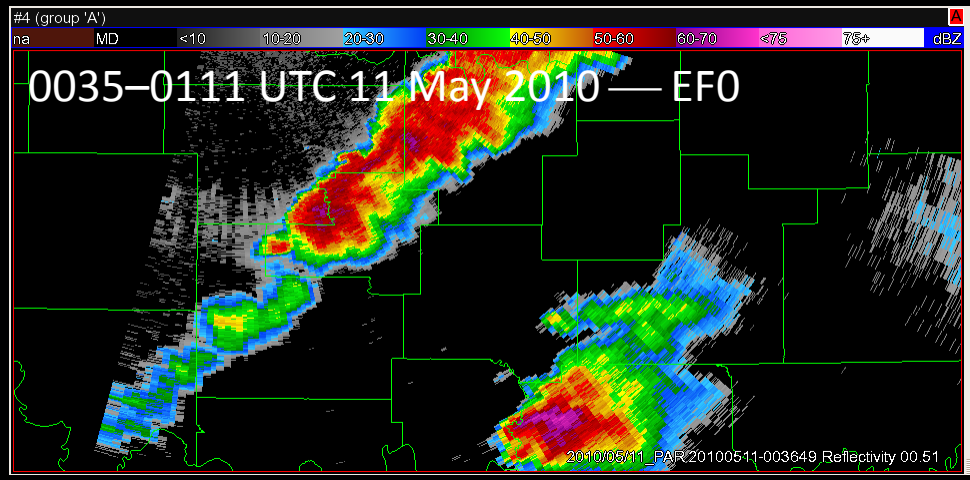


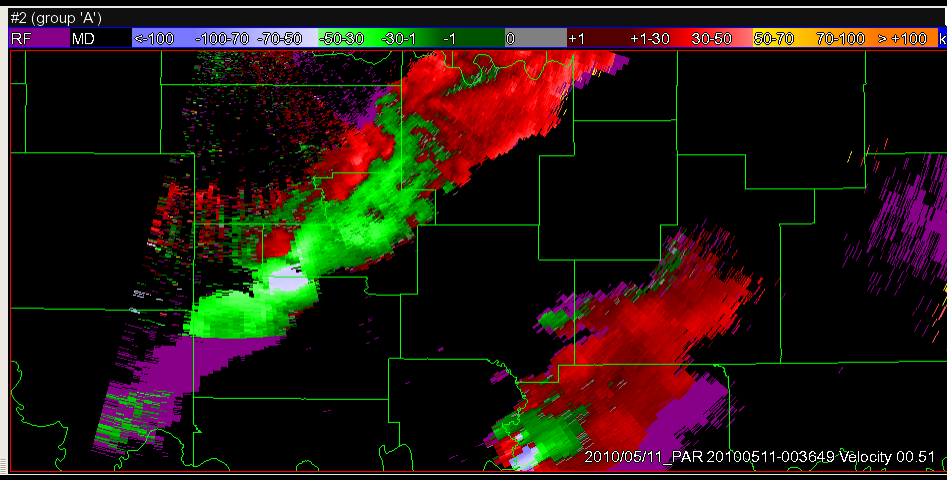
- 12 NWS Forecasters working individually
  - 2 per week over 6 weeks (June – Aug)
- 4 supercell events
  - 2 tornadic, 2 non-tornadic

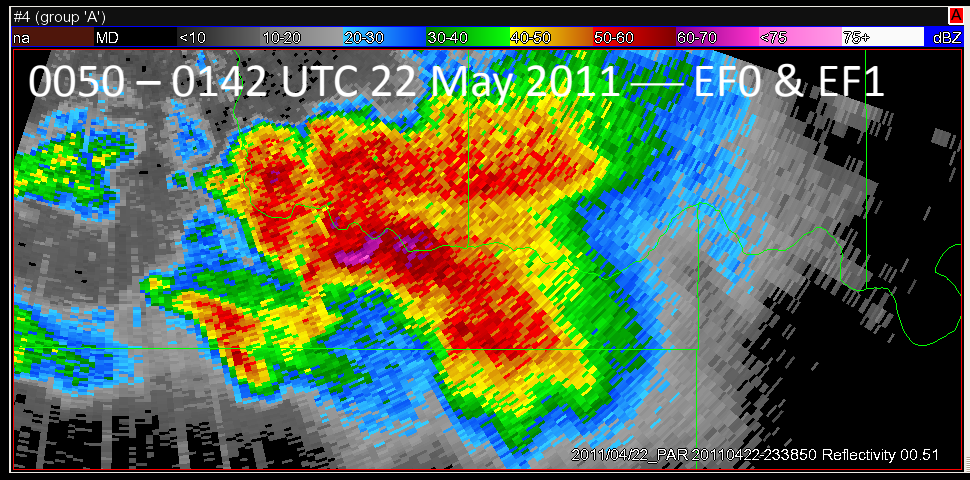


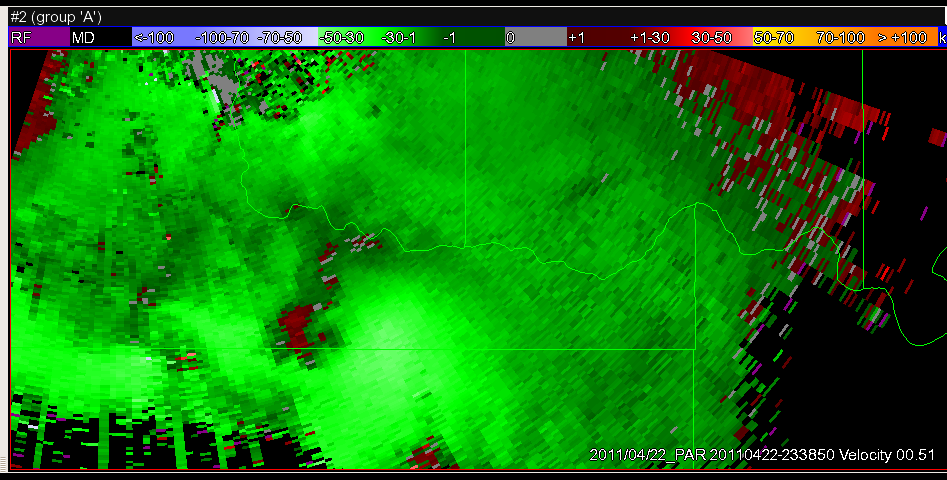
Tornadic Cases

0.5 deg



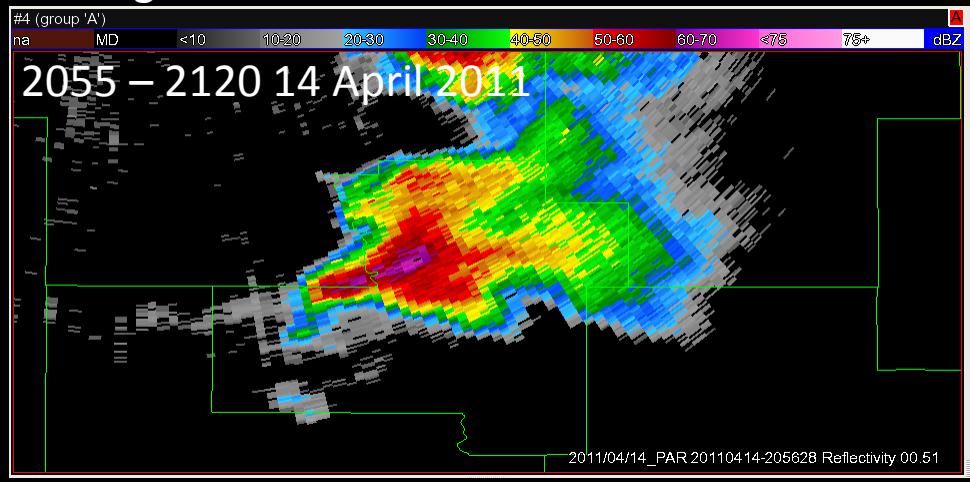


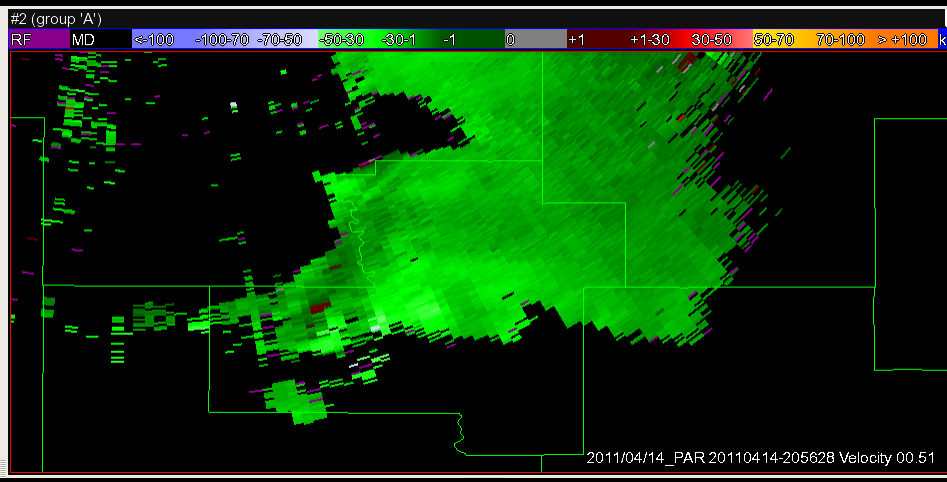


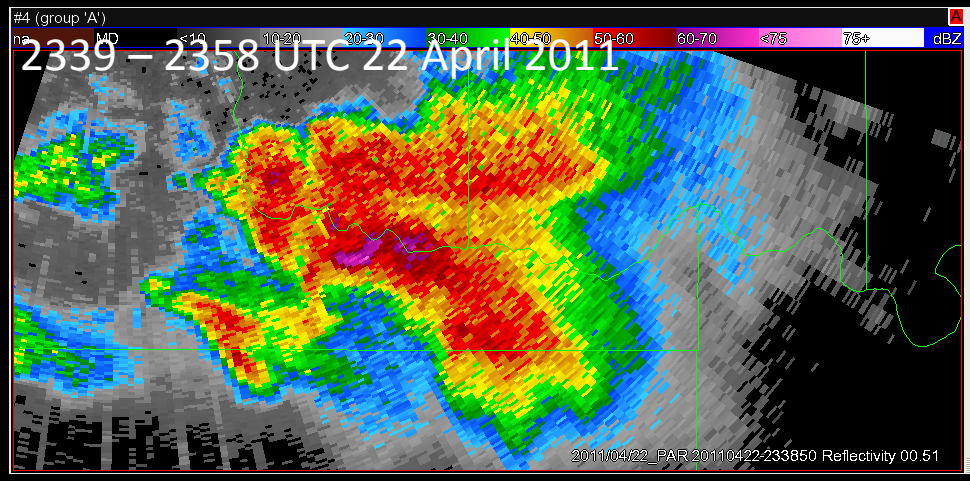


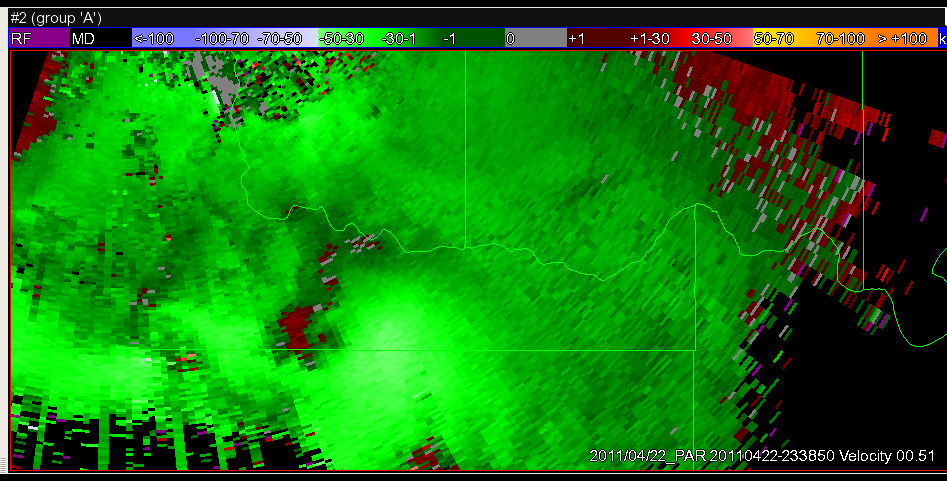
Null Cases

0.5 deg





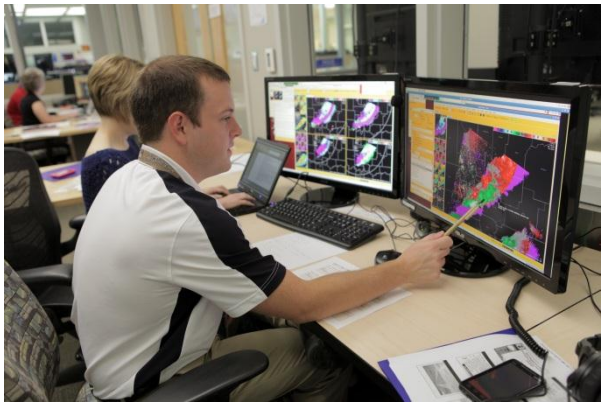




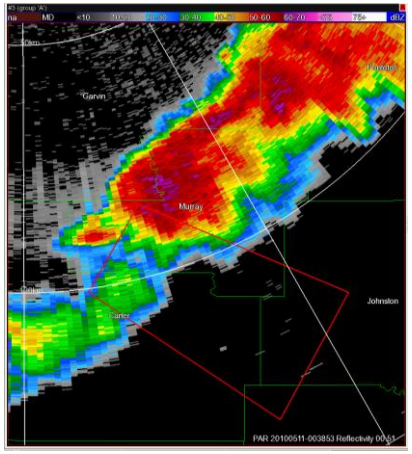
Data Collection

Work the Event → **Retrospect of decision process**

Video and screen recordings



Case Walk Through Time Line

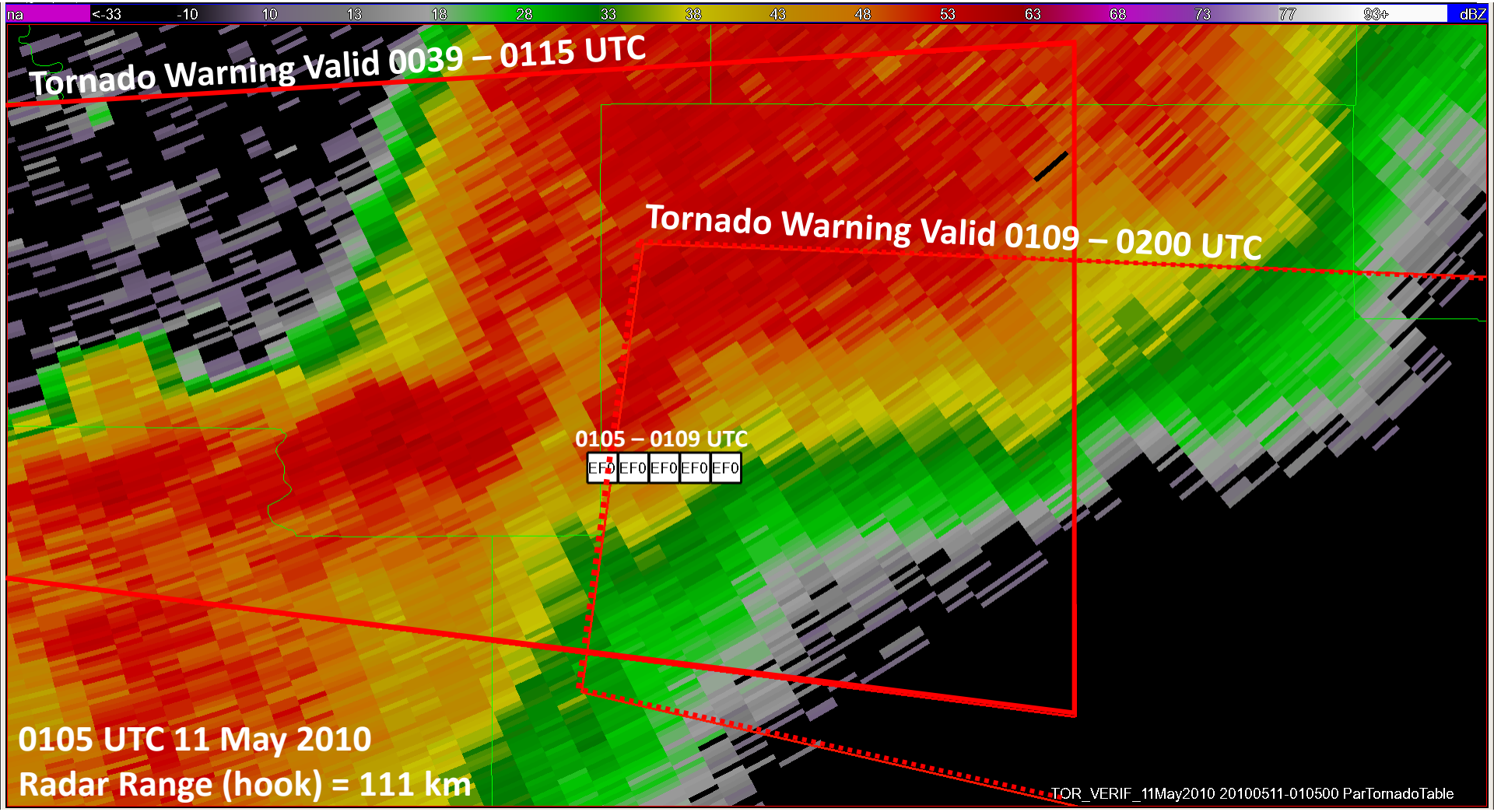


Any products issued

Path-relative Contingency Table		Point Along Tornado Path
Event Pt Warned	Yes	XP
	No	YP

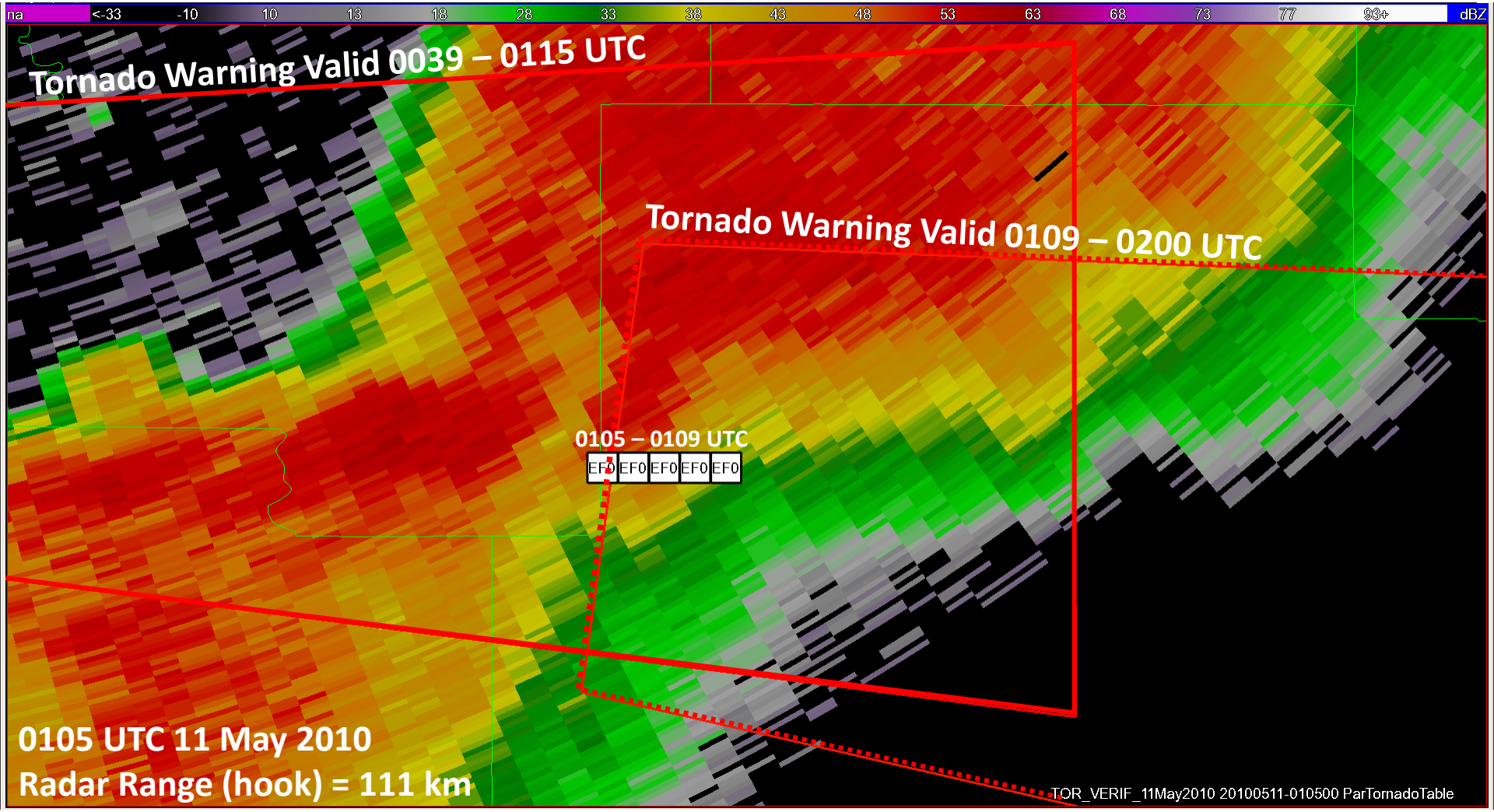
Traditional Contingency Table		Event Observed	
		Yes	No
Event Warned	Yes	X	Z
	No	Y	W

$$PPOD = \frac{\sum_{n}^{1} \frac{XP(n)}{XP(n) + YP(n)}}{X + Y}$$



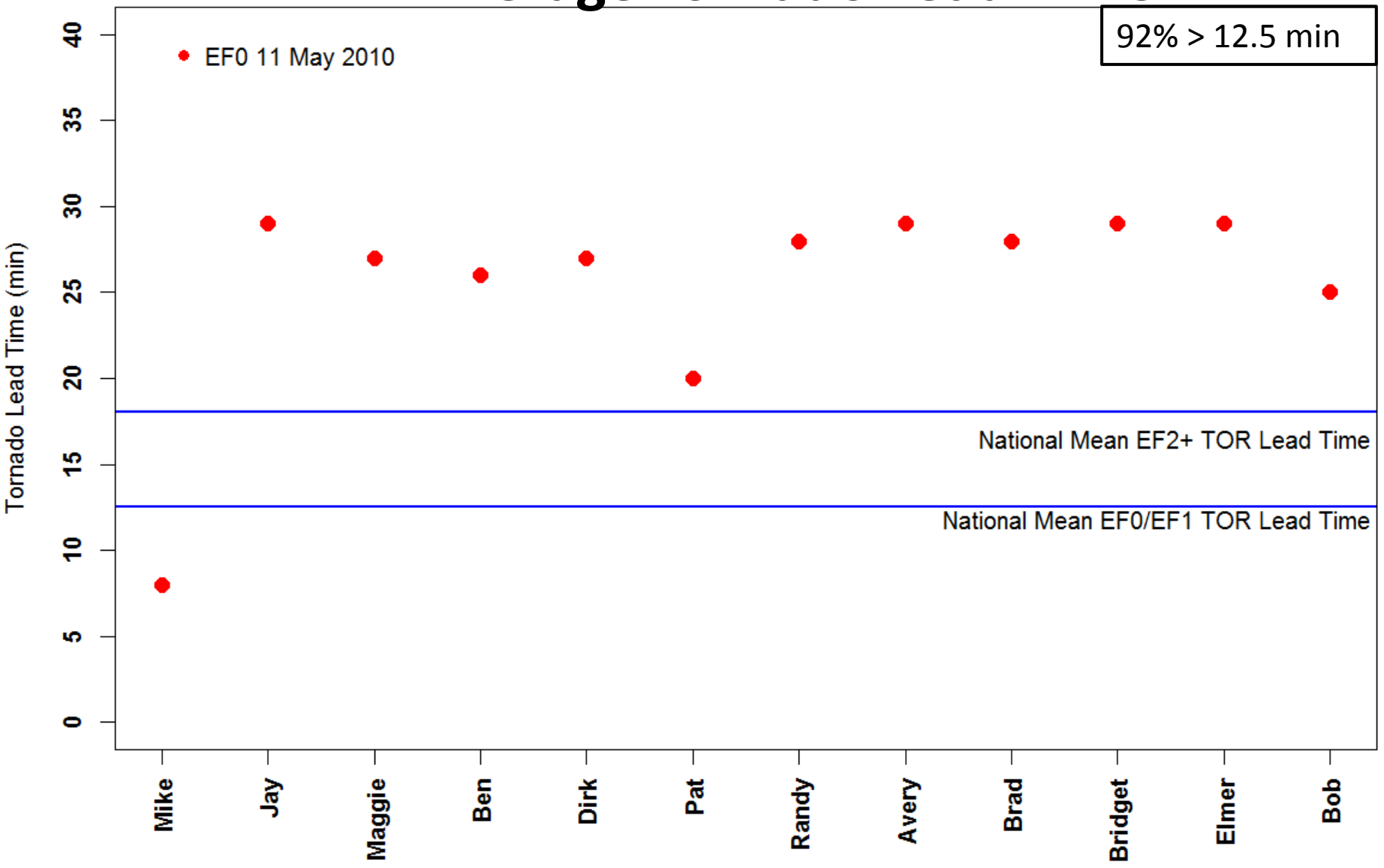
Path-relative Contingency Table		Point Along Tornado Path
Event Pt	Yes	XP
Warned	No	YP

$$TLT = \frac{\sum_{p}^{1} LT(p)}{XP + YP}$$



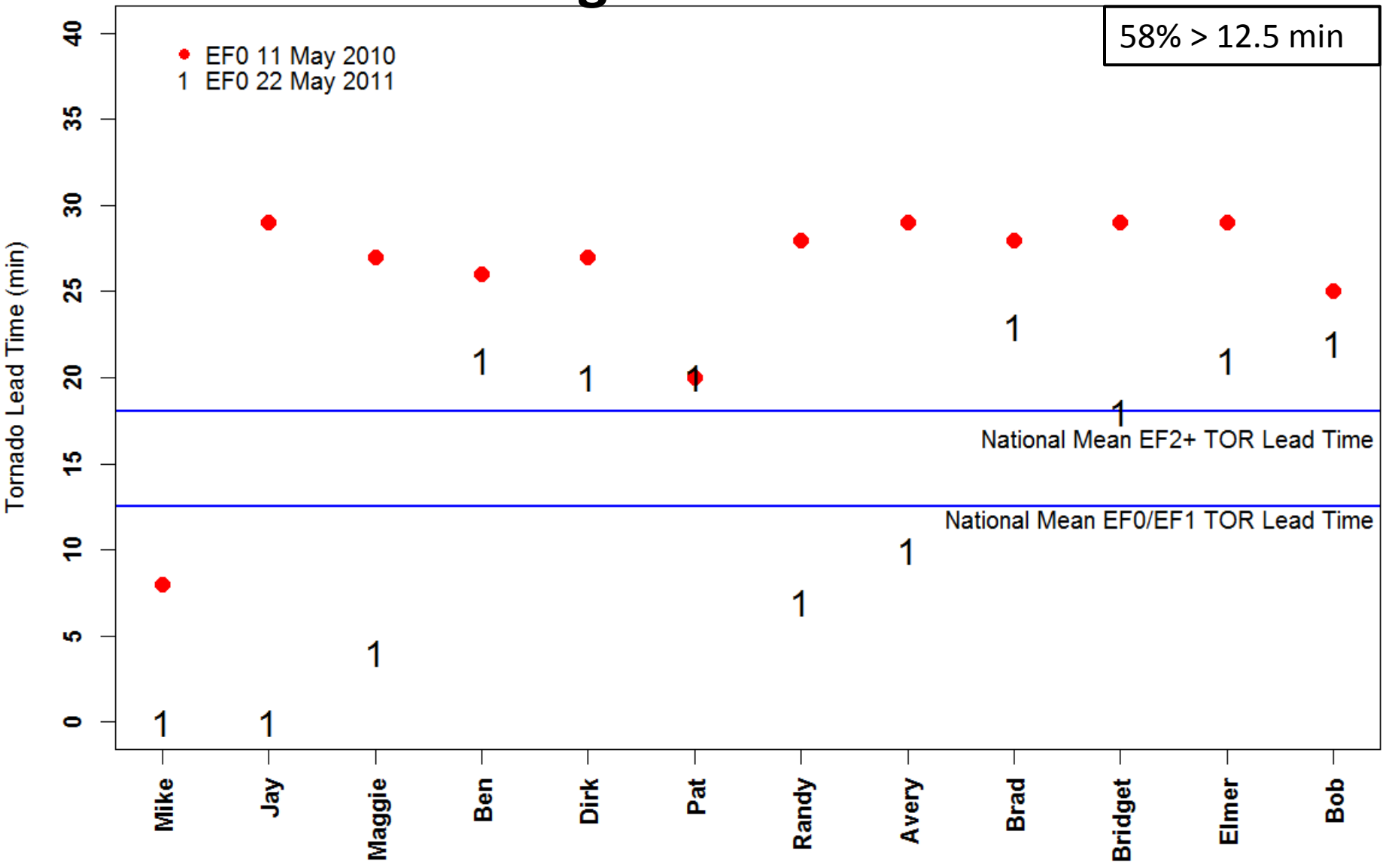
Tornado Lead Time

24 min Average Tornado Lead Time



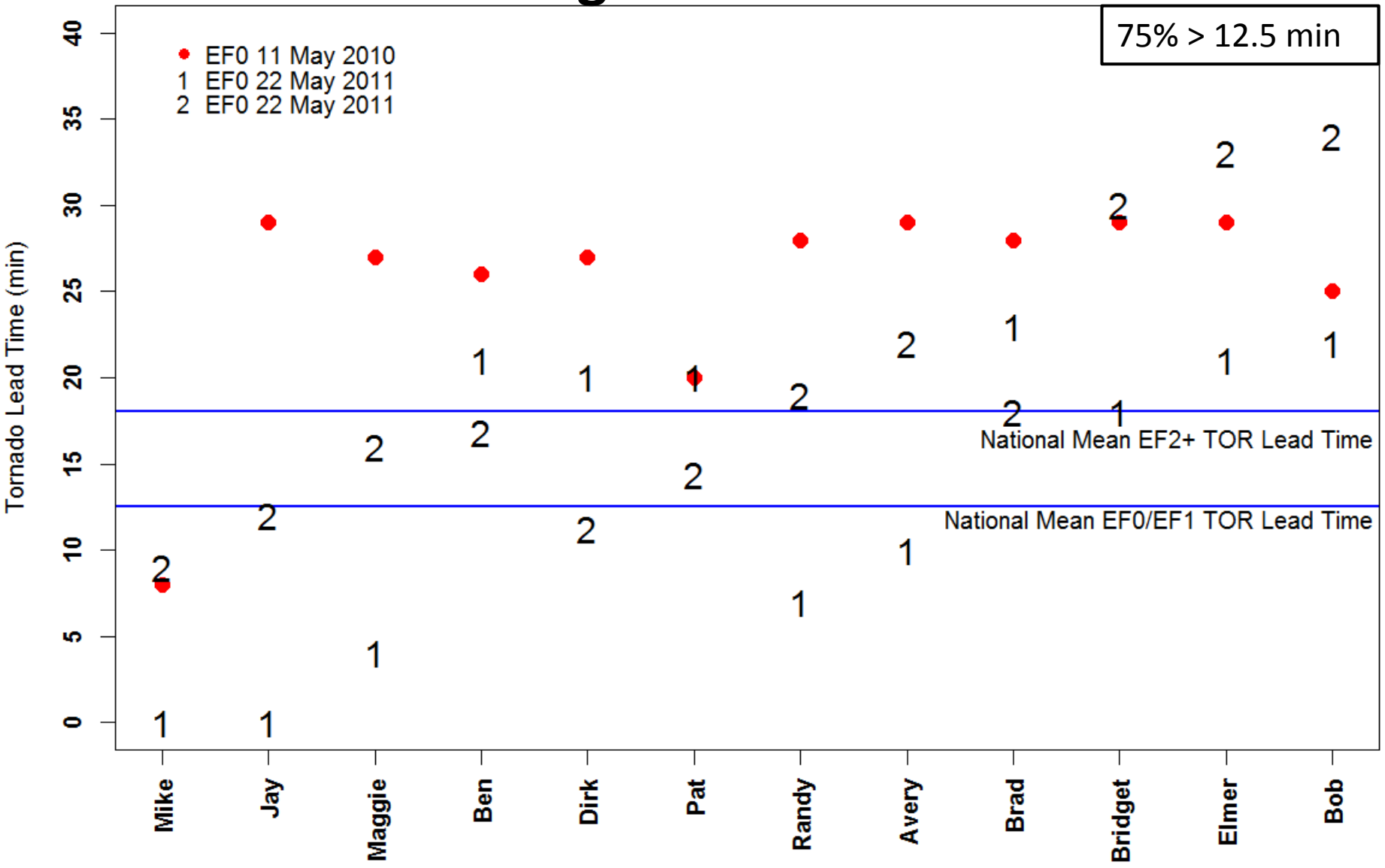
Tornado Lead Time

14 min Average Tornado Lead Time



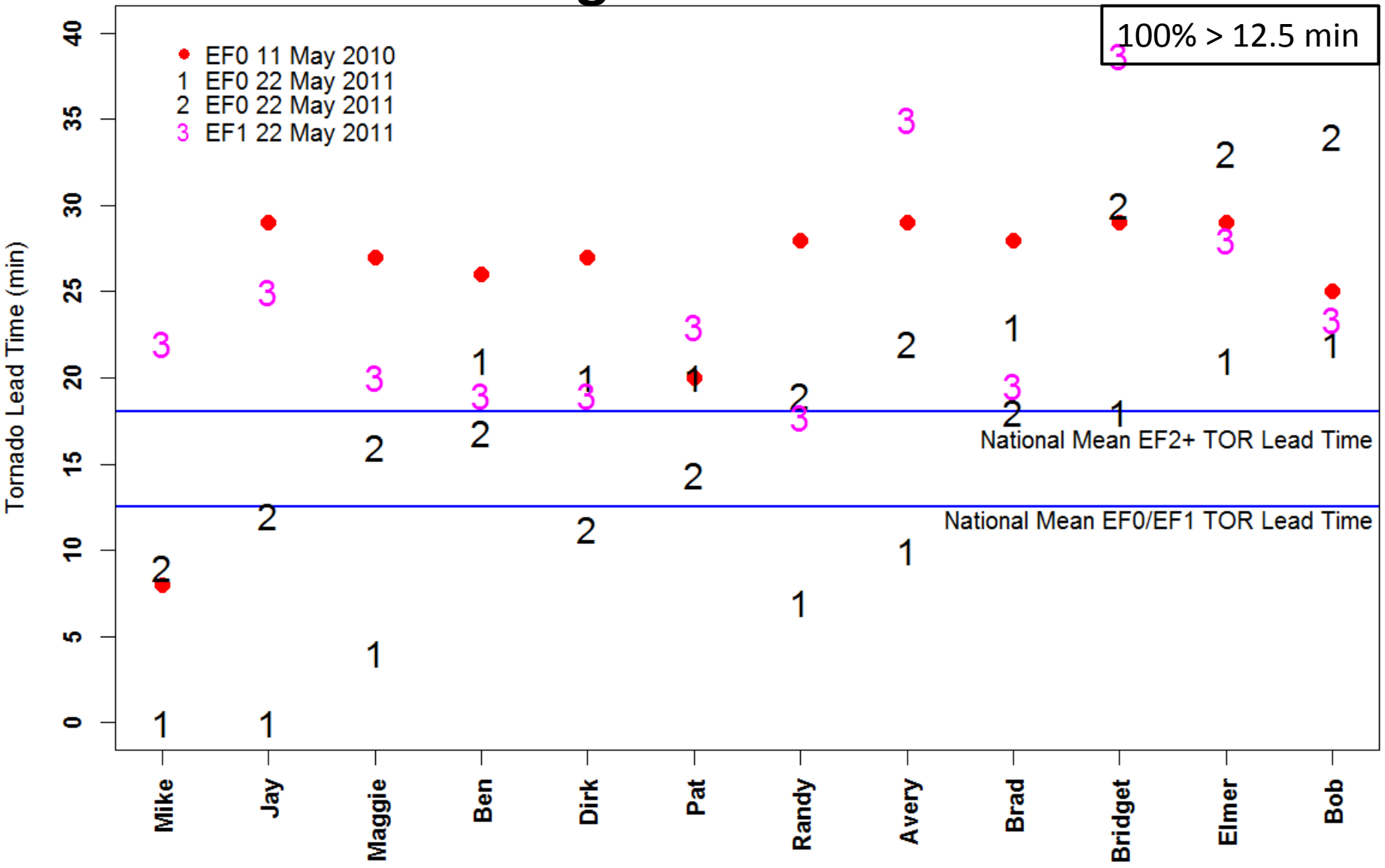
Tornado Lead Time

18 min Average Tornado Lead Time



Tornado Lead Time

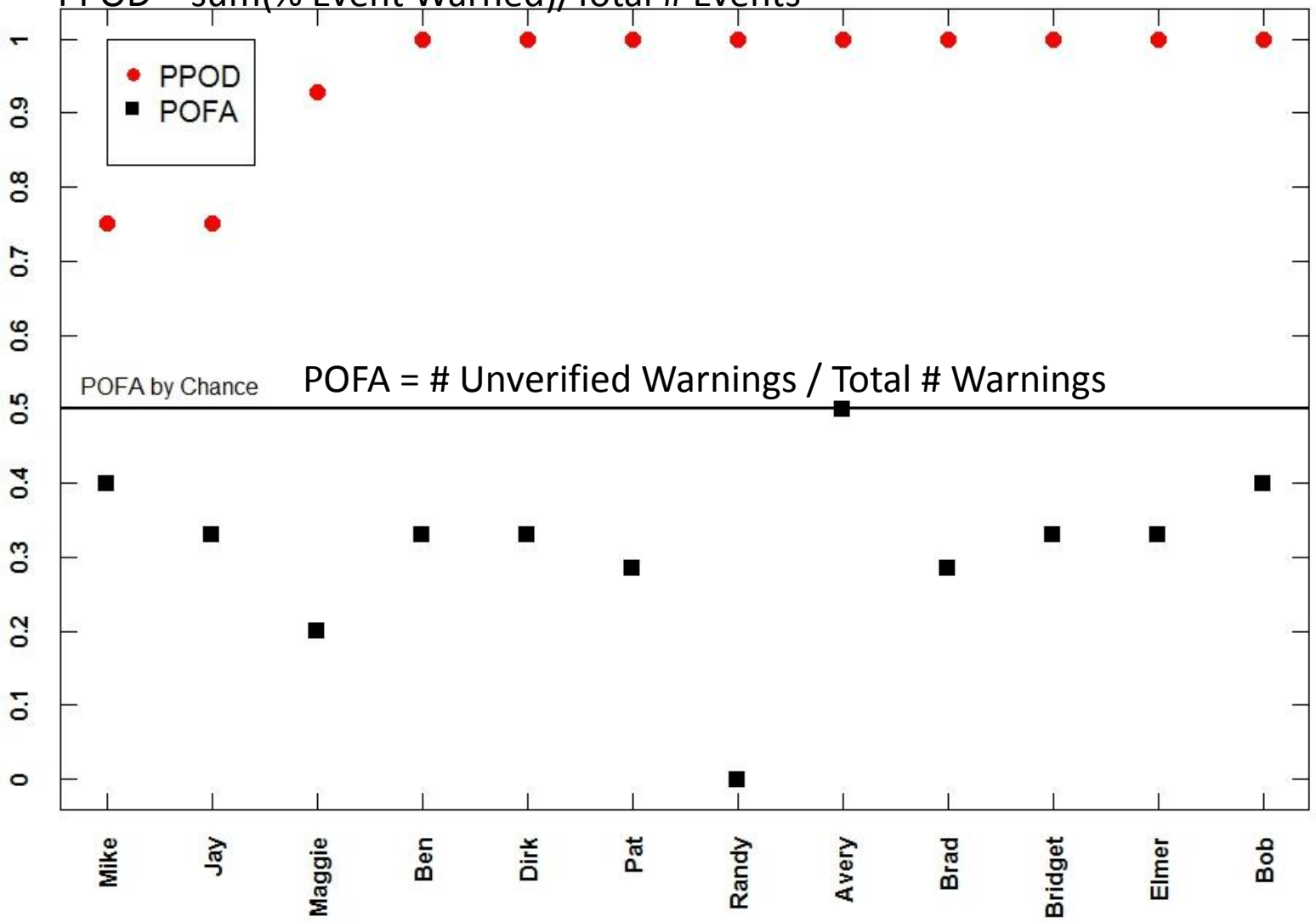
24 min Average Tornado Lead Time



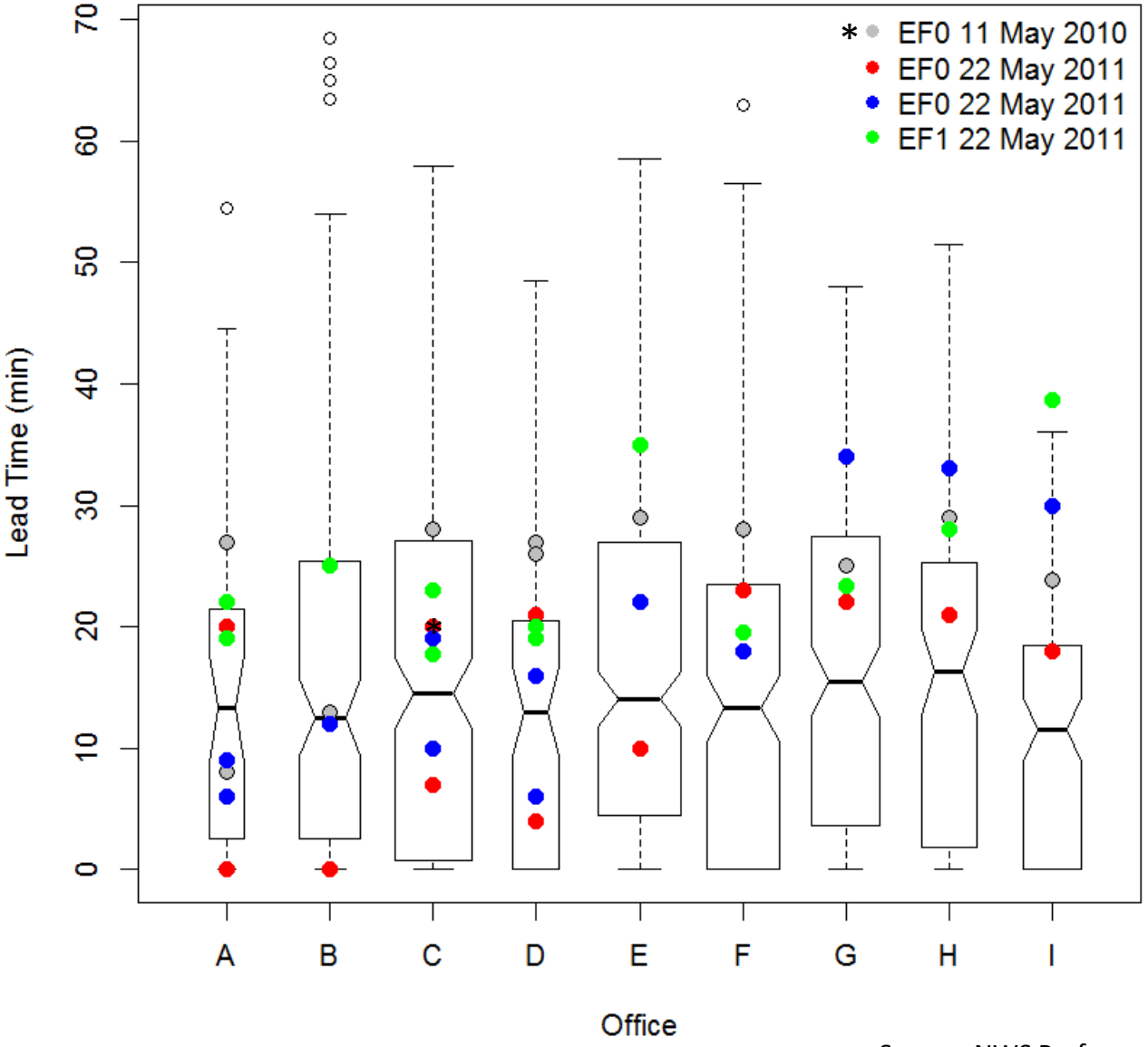
PARISE 2012 Results

Polygon POD / Prob. of False Alarm

PPOD = sum(% Event Warned)/Total # Events



Comparison to WFO Lead Times (EF0/EF1)



Source: NWS Performance Management Website

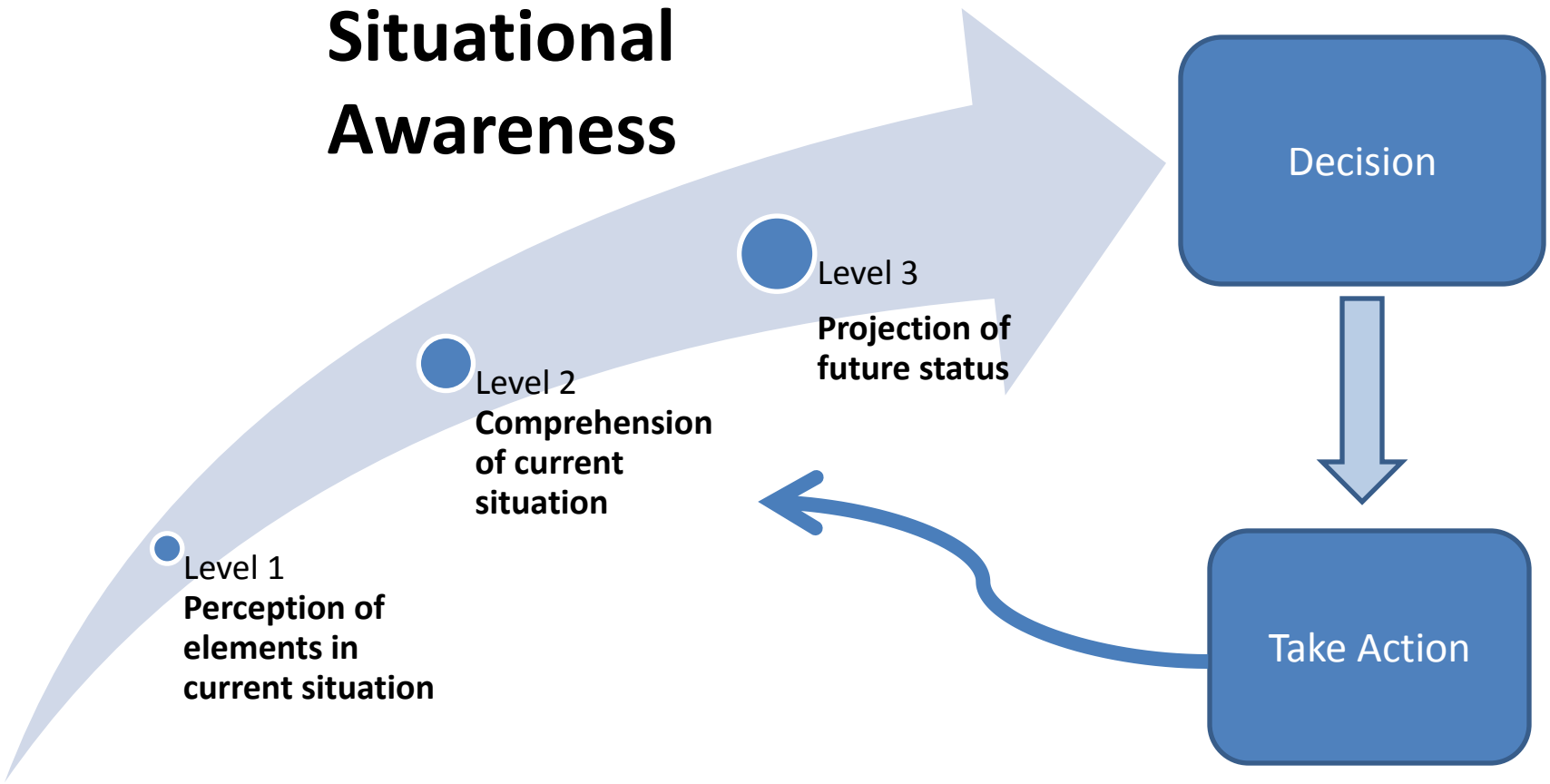
Forecaster Decision Making

Question:

What information did forecasters attain from the Phased Array Radar data that aided their warning decisions and ability to provide 21-min average lead times?

Situational Awareness in Dynamic Decision Making

Adapted from Endsely (1995)

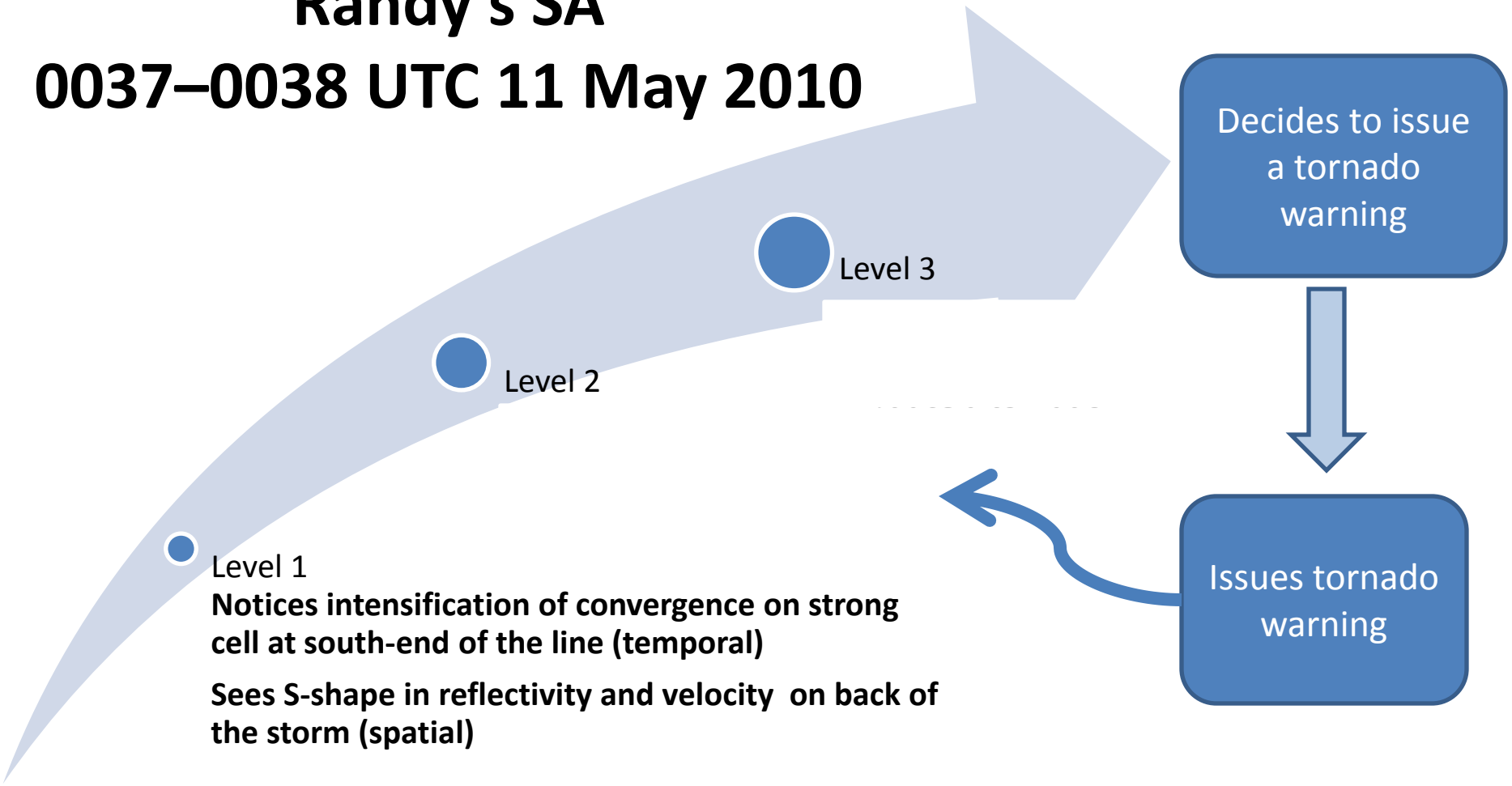


Situational Awareness in Dynamic Decision Making

Adapted from Endsely (1995)

Randy's SA

0037–0038 UTC 11 May 2010

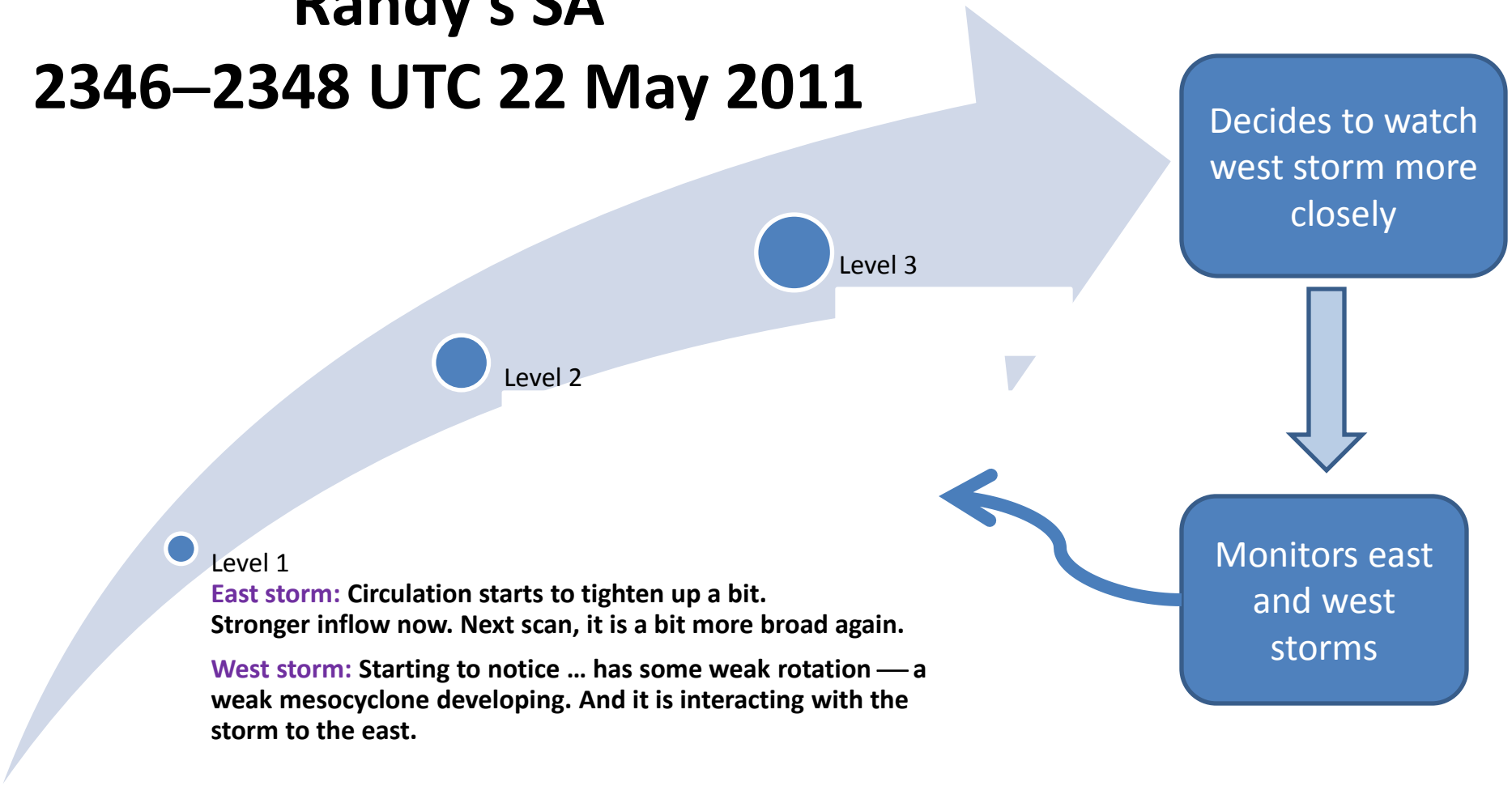


Situational Awareness in Dynamic Decision Making

Adapted from Endsely (1995)

Randy's SA

2346–2348 UTC 22 May 2011



Verification Results

1) Use of PAR rapid-scan data by 12 NWS forecasters:

- ✓ **resulted in 21 min mean tornado lead time for EF0 and EF1 tornadoes (vs 12.5-min national average)**

- ✓ **resulted in PPODs ≥ 0.75; 75% of PPODs = 1.0**
  POFAs ≤ 0.5; 75% of POFAs < 0.4

2) Use of PAR data could provide the public several minutes more lead time to protect themselves and their families from EF0 and EF1 tornadoes, compared to the national average tornado lead time.